

3/RRTS

10/511652
DT05 Rec'd PCT/PTO 18 OCT 2004

DESCRIPTION

ELECTRONIC APPARATUS

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TECHNICAL FIELD

The present invention relates to electronic apparatus such as a PDA, a cell phone, and a simplified cell phone (PHS (registered trademark)).

BACKGROUND ART

10 As shown in Figs. 4-6, for convenience in carrying, an electronic apparatus such as a PDA, a cell phone, or a simplified cell phone (PHS (registered trademark)) generally employs a structure in which a first casing 11 incorporating a display 14 and a second casing 12 incorporating a keyboard 15 are attached so as to freely rotate to each other by a bearing portion 13, and the first casing 11 and the second casing 12 can be folded together. When the electronic apparatus has a foldable structure, it is necessary that a speaker 16 for emitting a ringing sound be provided so as to be directed outward in the state that the first casing 11 and the second casing 12 are folded together so that a sufficiently loud ringing sound is emitted outward even in the state that the first casing 11 and the second casing 12 are folded together. For example, as shown in Fig. 6, the face of the first casing 11 that is opposite to the face having the display 14 is formed with a sound emission hole 17 and the speaker 16 for emitting a ringing sound is provided in the first casing 11 so as to be opposed to the sound emission hole 17.

25 However, in recent years, the thickness of electronic apparatus of the

above kind has decreased rapidly and the display 14 has come to be required to be large. As a result, the internal space of the first casing has become very small. This raises a problem that the driving of the speaker 16 itself is made difficult and hence satisfactory characteristics cannot be obtained.

5 The present invention has been made in view of the above problems in the art, and an object of the invention is to provide a superior electronic apparatus capable of securing satisfactory characteristics all the time even with a simple structure.

10 DISCLOSURE OF THE INVENTION

 An electronic apparatus according to the present invention is configured as follows. A first casing and a second casing can be folded together along a bearing portion. The front face and the back face of one of the first and second casings are formed with respective sound emission holes that are
15 opposed to each other. A speaker is provided at a position corresponding to the sound emission holes.

 This configuration provides effects that a sound generated by the speaker can be emitted from both of the front side and the back side of the body, and that a sound generated by the speaker can be heard efficiently in both of a
20 state that the body is opened and a state that the body is folded.

 Further, the electronic apparatus is configured in such a manner that the front face of the other of the first and second casings is formed with a through hole that is faced to the sound emission hole in a state that the first and second casings are folded together.

25 This configuration provides the following effect. Even in the state that

the first and second casings are folded together and hence no space exists between the first and second casings, the first and second casings communicate with each other through the sound emission hole and the through hole that are opposed to each other. Therefore, the speaker is driven efficiently and a sufficiently loud sound is emitted outward.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of an electronic apparatus according to an embodiment of the present invention;

Fig. 2 is a perspective view of the electronic apparatus according to the embodiment of the invention in a state that its first and second casings are folded together;

Fig. 3 is a side sectional view of an important part of the electronic apparatus according to the embodiment of the invention in the state that its first and second casings are folded together;

Fig. 4 is a perspective view of a conventional electronic apparatus;

Fig. 5 is a perspective view of the conventional electronic apparatus in a state that its first and second casings are folded together; and

Fig. 6 is a side sectional view of an important part of the conventional electronic apparatus in the state that its first and second casings are folded together.

In the drawings, reference numeral 1 denotes a first casing; 2, a second casing; 3, a bearing portion; 4, a display; 5, keys; 6, a sound emission hole; 7, a speaker; 8, a sound emission hole; and 9, a through hole.

BEST MODE FOR CARRYING OUT THE INVENTION

An embodiment of the present invention will be hereinafter described with reference to the drawings.

Fig. 1 is a perspective view of an electronic apparatus according to the embodiment of the invention. Fig. 2 is a perspective view of the same electronic apparatus in a state that it is folded. Fig. 3 is a side sectional view of an important part of the same electronic apparatus in the state that it is folded.

As shown in Figs. 1-3, the electronic apparatus according to the embodiment of the invention includes a first casing 1 in which a display 4 is provided on the front side thereof and a second casing 2 in which various kinds of keys 5 are provided also on the front side thereof. The first casing 1 and the second casing 2 are attached so as to freely rotate to each other by a bearing portion 3.

The back face of the first casing 1, that is, the face that is located outside in the state of Fig. 2 that the first casing 1 and the second casing 2 are folded together, is formed with a first sound emission hole 6. A speaker 7 for emitting a ringing sound, a speech sound, etc. is provided inside the first casing 1 so as to be opposed to the sound emission hole 6. Further, the front face of the first casing 1 is formed with a sound emission hole 8 that is opposed to the speaker 7, and the front face of the second casing 2 is formed with a through hole 9 that is opposed to the sound emission hole 8. That is, as shown in Fig. 3, the sound emission hole 8 and the through hole 9 are opposed to each other in the state of Fig. 2 that the first casing 1 and the second casing 2 are folded together.

Although not shown in any drawings, each of the sound emission holes 6 and 8 and the through hole 9 is provided with, as appropriate, a mesh-like

protective film, decorative plate, or the like capable of transmitting sound.

As described above, in the electronic apparatus according to the embodiment, the sound emission holes 8 and 6 are provided on the front face and the back face of the first casing 1 respectively, and the speaker 7 for emitting a ringing sound, a speech sound, etc. is provided at such a position as to be opposed to the sound emission holes 8 and 6. This structure provides the following advantage. Even if the internal space of the first casing 1 is made small because the first casing 1 is thinned and the display 4 is increased in size, a sound generated by the speaker 7 can be emitted outward efficiently through the sound emission holes 8 and 6 that are formed on the front side and the back side of the first casing 1, respectively, and hence good acoustic characteristics can always be secured. In particular, this embodiment provides the following advantage. Since the sound emission holes 8 and 6 are provided on the front side and the back side of the first casing 1, respectively, a sound generated by the speaker 7 can be heard directly through the sound emission holes 8 and 6 in both of the state (of Fig. 1) that the first casing 1 and the second casing 2 are opened and the state (of Fig. 2) that the first casing 1 and the second casing 2 are closed. This structure allows a user to hear a loud sound and hence easily recognize the sound.

The embodiment also provides the following advantage. The through hole 9 is formed on the front side of the second casing 2 at such a position as to be opposed to the sound emission hole 8. Therefore, even in the state (of Fig. 2) that the first casing 1 and the second casing 2 are folded together and no space exists between the first casing 1 and the second casing 2, the inside spaces of the first casing 1 and the second casing 2 communicate with each other through the

sound emission hole 8 and the through hole 9. The space behind the speaker 7 is substantially enlarged, so that the speaker 7 is driven efficiently. At the same time, this leads to improvement in the acoustic characteristics of the speaker 7 and hence serves to secure good acoustic characteristics.

5 In this embodiment, the speaker 7 is provided so as to be directed to the sound emission hole 6. However, the invention is not limited to such a configuration. The speaker 7 may be provided so as to be directed to the sound emission hole 8. Further, although the embodiment is such that the speaker 7 and the sound emission holes 6 and 8 are provided in the first casing 1 and the
10 through hole 9 is provided in the second casing 2, another structure is possible in which the speaker 7 and the sound emission holes 6 and 8 are provided in the second casing 2 and the through hole 9 is provided in the first casing 1.

Although the invention has been described in detail by referring to the particular embodiment, it is apparent to a person skilled in the art that various
15 changes and modifications are possible without departing the spirit and scope of the invention.

This application is based on Japanese Patent Application No. 2002-116250 filed on April 18, 2002, the disclosure of which is incorporated herein
by reference.

INDUSTRIAL APPLICABILITY

As described above, the invention provides the advantages that a sound generated by the speaker can be emitted from both of the front side and the back side of the body, and that even if the body is thinned and the internal
25 space is made small, the speaker can be driven efficiently and a sound generated

by the speaker can be heard efficiently in both of the state that the body is opened
and the state that the body is folded.